Model 835-3 User's Manual

Fast-Switching Low-Noise Signal Generator

Berkeley Nucleonics Corporation

Tel 415-453-9955 info@berkeleynucleonics.com

Fax 415-453-9956 www.berkeleynucleonics.com

Contents

1. Introduction to the 835-3 4
General Features and Functions *4*
Options *4*
Front Panel Overview (non-HC version) *5*
Rear Panel Connections *6*
2. Getting Started 7
System Requirements *7*
Unpacking the 835-3 ..... *7*
Initial Inspection *7*
Starting the 835-3 ..... *7*
Applying Power *8*
Connecting to LAN *8*
Connecting to PC without LAN *8*
Installing the 835-3 Remote Client *8*
Troubleshooting the LAN Interconnection *9*
Shutting Down the 835-3 ..... *9*
3. Using the Graphical User Interface (GUI) 9
Start the 835-3 GUI *9*
Controlling Multiple Signal Generators from one PC *10*
Network Configuration *10*
Perform Firmware Upgrade *11*
Store and Revoke Instrument States *11*
Using Toolbars *12*
Basic CW Operation *13*
Sweeps *14*
Frequency Sweep (Figure 7) *14*
Frequency Linear Sweep *15*
Frequency Log Sweep *15*
Frequency Random Sweep *15*
Power Sweep (Figure 8) *15*
List Sweeps (Figure 9) *16*
Modulation Control *19*
Reference *20*
Using the Trigger options (Figure 14) *21*
LF OUT Control *23*
Combined Modulation *24*
4. Local Operation (HC Option) 24
Displayed Parameter Formats *25*
CW Display *25*
Main Menu Display *26*
Frequency Sweep Submenu *27*
Power Sweep Submenu *28*
List Sweep Submenu *29*
Modulation Submenu *30*
Pulse Mod Submenu *30*
Amplitude Mod Submenu *31*
Frequency Mod Submenu *31*
Reference Submenu *32*
Trigger Submenu *32*
LF OUTPUT Submenu *33*

LAN Configuration Submenu *34*
Display Settings Submenu *35*
6. Programming the *835-3* 35
Using Sockets LAN *36*
Using and Configuring VXI-11 ..... *36*
Using SCPI for 835-3 ..... *37*
Using Telnet LAN *37*
7. Battery Operation (B3 Option) 38
8. Extended Power Range (PE/PE2 Options) 40
9. Maintenance and Warranty Information 40
Adjustments and Calibration *40*
Repair *40*
Safety *41*
Warranty Information *41*
Equipment Returns *41*
Company Details *42*

1. Introduction to the 835-3

Your Model 835-3 Series Signal generator kit contains the following items:

- 835-3 mainframe
- Universal power adaptor (AC 100 – 240V) with UK, US, EU plugs
- Ethernet Cable
- 835-3 software CD
- 835-3 Get Started Manual

It is strongly recommended to use the original power adaptor (as supplied with the device) to guarantee save and reliable operation of the 835-3.

General Features and Functions

The BNC Model 835-3 RF Signal Generator provides:

- 9 kHz to 3300 MHz frequency range (settable to 3400 MHz)
- –30 to +13 dBm power levelled range (option PE: -100 to +13dBm, option PE2: -135 to +13 dBm)
- Modulation capabilities for FM, PM, AM and pulse modulation
- Fast frequency, power and list sweeps
- Light weight, optinal internal rechargeable batteries
- 3- inch status LCD
    - Long-term support: Software upgrades (firmware and PC based) are available to download. You can also call our technical specialists for support. You can continue to use both of these services free of charge for the lifetime of the product.
- Universal LAN interface
- 18 months calibration cycle

Options

B3: internal rechargeable battery (3 hours operation)

HC: front panel user interface with rotary knob

PE: extended power range (-100 to +13 dBm)

PE2: extended power range (-135 to + 13 dBm)

RM: 19'' rack mount kit

Unless noted otherwise, this manual describes the basic version of the instrument.

Front Panel Overview (non-HC version)

The front panel contains a status display, a RF output female N-type connector, and a RF on/off key (Figure 1). The LCD screen shows information on the current function. Information includes status indicators, frequency and amplitude settings, current connectivity status, and error messages.

Figure 1 8 3 5 - 3 Front Panel View

RF On / Off button The **ON / OFF** key toggles between RF output on and RF output off. The green light (*) is indicating whether the RF output is enabled (light on) or not.

RF 50Ω connector This female N- type connector provides the output for RF signals. The impedance is 50 ohm. The damage level is +30 dBm maximum. The maximum allowed DC level is +/- 10 V.

Displayed Parameter Formats

Main LCD display

There are two parameters displayed in the main menu: frequency in Hz (1st line) and RF amplitude in dBm (2nd line).

On the 3rd line the lock status to an external reference source is displayed.

The 4th line provides IP address of the controlled source. The display is updated each time a value is changed.

Frequency - The current value for center frequency. Units: Hz

Range: 9'000 to 3'400'000'000 Hz

Resolution: 0.001 Hz

Amplitude - The current value for output power. Units: dBm

Range: -70.0 to +25.0 dBm (option PE/PE2: -150.0 to + 25 dBm)

Resolution 0.1 dB

Phase lock – External reference disabled, not locked or locked to integer multiple of 1 MHz

Range: 1 to 100 MHz

LAN – The current IP address of the instrument

Rear Panel Connections

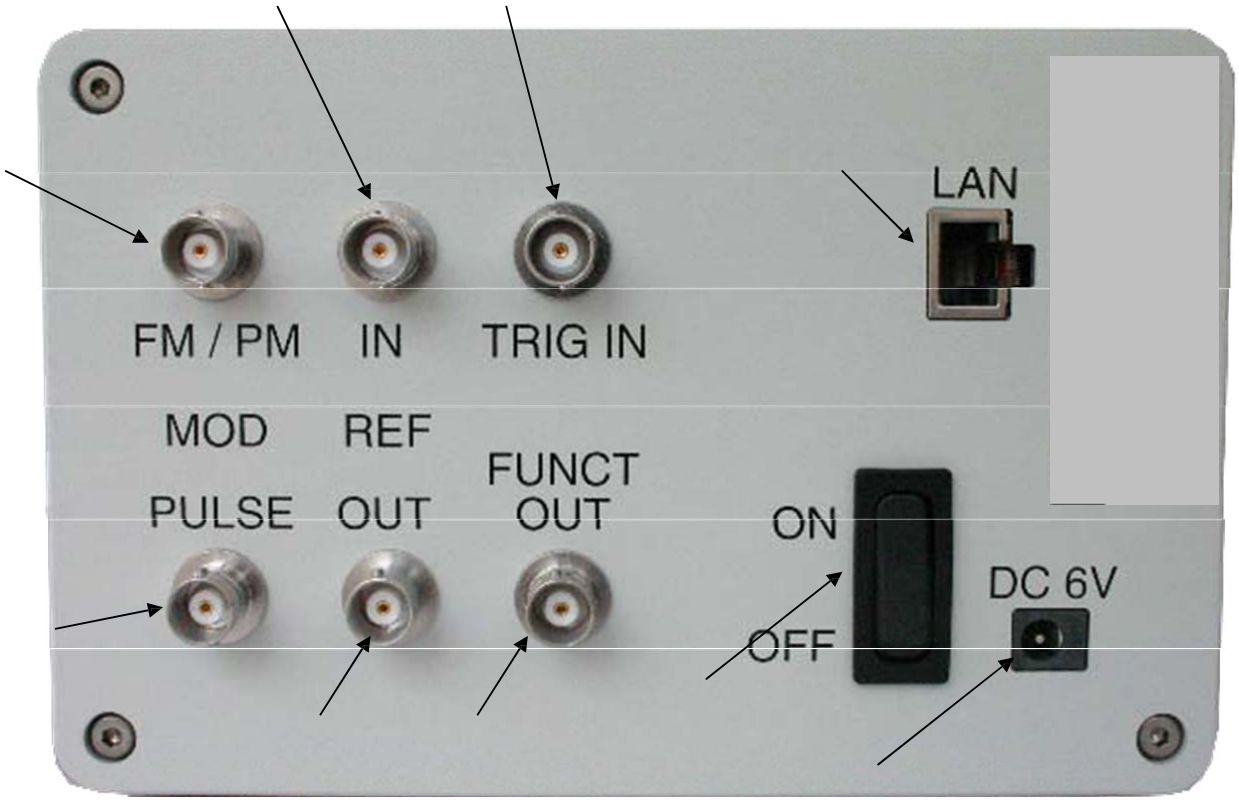


Figure 2 835-3 Rear Panel View

1 Power switch The power switch disconnects the signal generator from the DC input completely, including the internal high-stability reference. After switching on this switch, the signal generator enters into standby with the OCXO warming up and RF out switched off. The red power LED (option HC only) on the front panel is turned on.

2 DC IN power receptacle The power receptacle accepts a two-pin plug from the external 6 V DC power adapter

3 RJ-45 host connector Used for connecting with a controller, such as a PC or Labtop.

4 FM/PM MOD IN connector This BNC input connector accepts a 0 to 2 V (peak) signal for FM modulation. The damage level is 4 Vrms.

5 REF IN connector Female BNC connector, accepts a TTL or -5 to +15 dBm sine signal from an external reference oscillator that is within ±1 ppm of the programmed reference frequency. The nominal input impedance is 50 ohm.

6 TRIG IN connector Female BNC connector, accepts a TTL signal from an external trigger source. The input impedance is 1Mohm.

7 PULSE MOD IN connector This BNC input connector accepts TTL signal for pulse modulation. The damage level is 3 Vrms.

8 REF OUT connector Female BNC connector is for an output of the internal 100 MHz reference frequency, which has a nominal output level greater than 8 dBm, and an output impedance of 50 ohm.

9 FUNCT OUT connector Female BNC connector is used as a multiple purpose output. It can be programmed as trigger output, as video output during pulse modulation, and as output for the low frequency function generator (standard on instruments with serial no. above xx00100).

2. Getting Started

System Requirements

To ensure that your Model 835-3 signal generator operates correctly with the graphical user interface, you must have a computer with at least the minimum system requirements to run one of the supported operating systems.

Operating system Windows™ 2000 SP4, XP SP2 or Vista (32-bit versions only)
Ethernet Port 10/100/1000M LAN

Unpacking the Model 835-3

Remove the 835-3 materials from the shipping containers. Save the containers for future use.
The standard 835-3 package includes:

1 Synthesized Signal Generator
1 An Ethernet Cable
1 Universal DC power adapter
1 835-3 Software & Manual CD
1 835-3 Get Started Manual

Initial Inspection

Inspect the shipping container(s) for damage. If container is damaged, retain it until contents of the shipment have been verified against the packing list and instruments have been inspected for mechanical and electrical operation.

Starting the 835-3

This section describes installation instructions and 835-3 verification tests.

Applying Power

1. Place the 835-3 on the intended workbench and connect the appropriate DC power supply to the receptacle on the rear of the unit. Make sure you use the included DC power supply. The 835-3 requires 6 V DC at 3 A maximum. **Using other supplies may lead to malfunction and damage of the Model 835-3.**

2. Press the Line on/off switch on the rear panel. The front panel display will illuminate. The instrument will initialize, and momentarily display the model number, firmware revision and product serial number. The display will then switch to the factory default display setting, showing preset frequency (100 MHz) and power (0.0 dBm), phase lock status (internal reference) and instrument IP number (0.0.0.0).

Connecting to LAN

Connect the 835-3 to your local area network (LAN) or directly to your PC/Labtop using the Ethernet cable. The instrument is configured to accept its dynamic IP number from the DHCP server of your network. If configured properly, your network router will assign a dynamic IP number to the instrument which automatically will be displayed on the screen. Your instrument is now ready to be controlled.

Connecting to PC without LAN

If you want to connect the instrument directly to your computer (without router in the LAN), you must use an Ethernet cable with crossover (not required if your computer has Gigabit-Ethernet). To work properly, the network card (NIC) of your computer must be configured to use DHCP. If your computer runs on a fixed IP the connection will fail. After a short time, the instrument will detect that no DHCP server is present and assign itself a default IP number 169.254.5.5. The instrument now must show 169.254.5.5 on the display. Should the IP not appear after more than 30 seconds, leave the LAN cable in place and turn the instrument off and then on again and retry.

Installing the 835-3 Remote Client

BNC's graphical user interface provides an intuitive control of the 835-3. It runs under any Windows™ 2000, XP or Vista operating system with minimum requirements. The DLL is embedded in the GUI application and requires .NET to be installed. To install the GUI on the computer, insert the Software and Manual CD into the CD/DVD drive. If the setup doesn't start automatically double click on the setup.exe to run the auto-installer.
The self-extracting setup provides easy installation and de-installation of the software. The setup program guides you in a few steps though the installation process. In case the .NET Framework is not installed on the current Windows™ operating system, the setup procedure automatically will assist you to install the required version. For this you will need an internet connection.

Troubleshooting the LAN Interconnection

Software does not install properly

- Make sure your installation CD is not damaged.
  - When Microsoft® .NET™ Framework is not installed make sure that your PC is to the internet connected during installation of the Software. If no internet connection is available, use the .NET™ Framework that is available on the installation CD.

Software cannot detect any 835-3:

- Make sure you have connected both PC and 835-3 to a common network.
  - If a direct connection is used, make sure you use an appropriate crossover Ethernet cable (10 and 100Mbit LAN only). Note that detection of the 835-3 can take several seconds.
  - Make sure that your (software) firewall enables the 835-3 software to setup a TCP/IP connection within the LAN. Under Windows XP you can do that like this: Open *Control Panel* under *Settings* in your *Start* menu. Then go to *Windows Firewall*. Click on *Exceptions* and then *add Program.* If the Software is in this list choose it and click *OK* otherwise you have to browse for the path to BNC Software. Finally close all open dialogs with *OK*. Now your Windows™ Firewall is ready for 835-3.

Shutting Down the Model 835-3

Press the Line on/off switch on the rear panel to off.

3. Using the Graphical User Interface (GUI)

BNC's graphical user interface provides an intuitive control of the 835-3. It runs under any Windows™ 2000, XP or Vista operating system. Make sure the software is installed properly and the computer's firewall configured properly.

Start the Model 835-3 GUI

Double-click the 835-3 shortcut that will appear on your desktop after the software has been successfully installed.

After start, the software will automatically detect existing 835-3 instruments. In the **CONTROL** tab (see Figure 3) the detected Devices are displayed. Clicking on one of the devices will instantly establish connection. Clicking on a different device will disconnect the old device, and connect to the selected device. By clicking on the **Refresh** button, a scan for new devices is started.

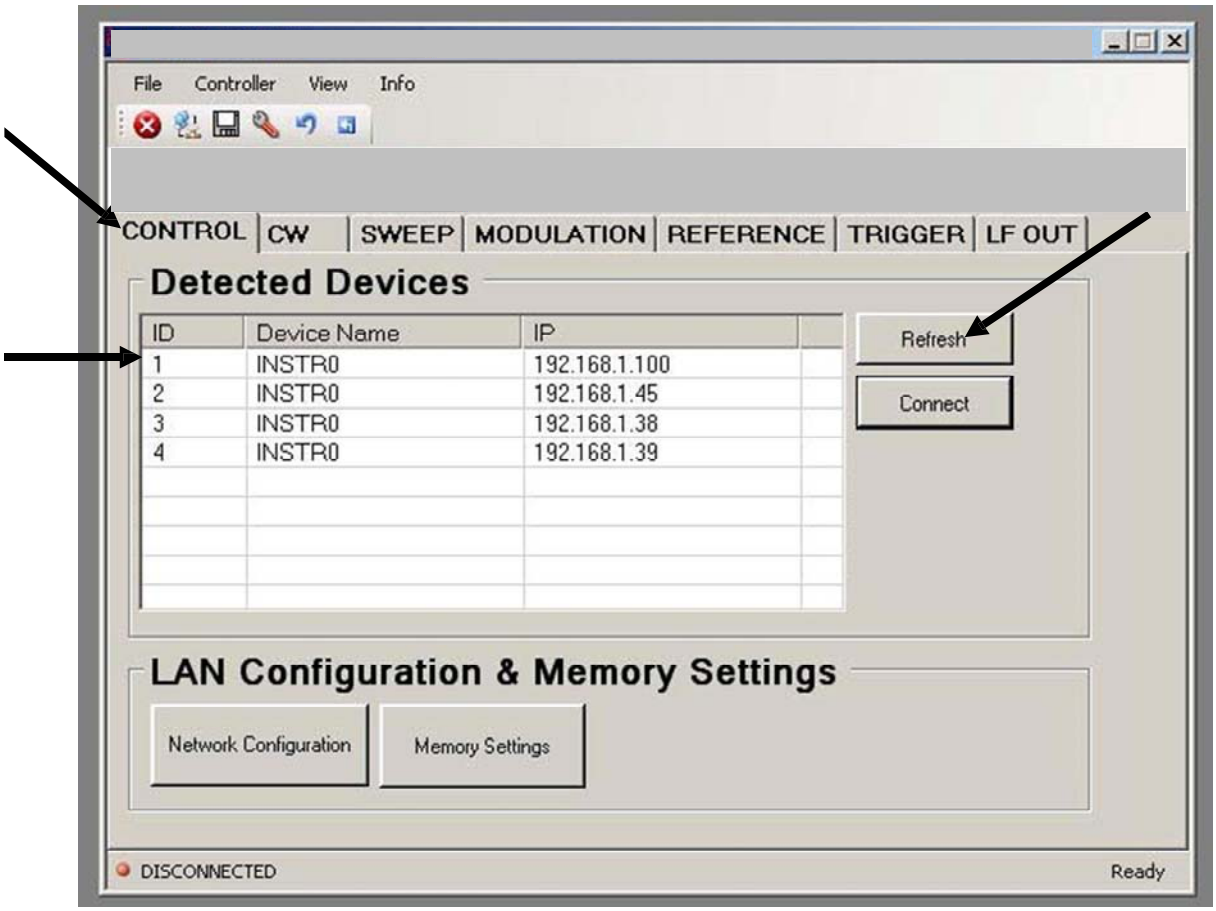


Figure 3 CONTROL tab

Controlling Multiple Signal Generators from one PC

You can easily control multiple 835-3 from a single computer over the LAN connection, but you need to start a separate GUI for every instrument.

Network Configuration

The **Network Configuration** button allows configuring the LAN settings as shown in Figure 4. Using a DHCP server can be enabled or a static IP can be entered by user. The device name can be modified as desired. The unit serial number and firmware revision are displayed on the bottom.

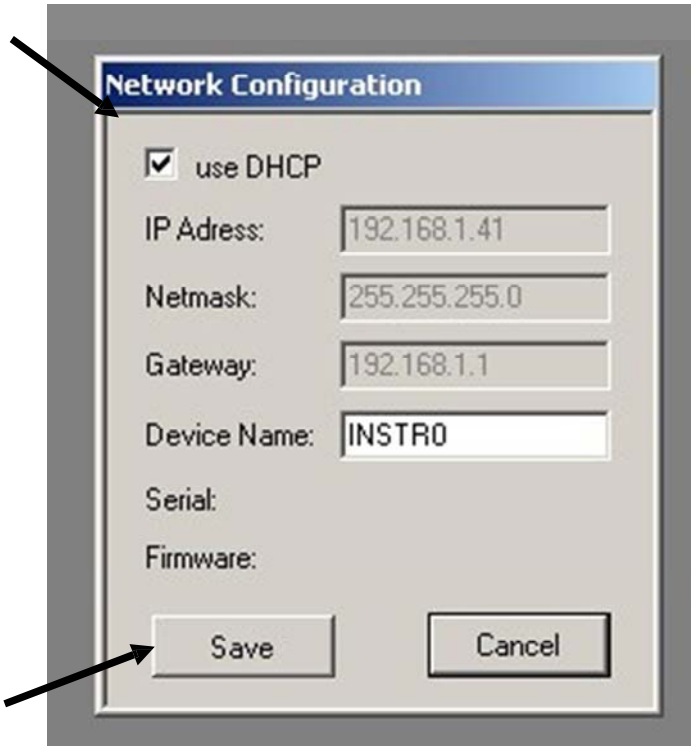


Figure 4 Network Configuration Submenu

Perform Firmware Upgrade

A firmware upgrade of the 835-3 can be done directly via the GUI. Make sure you are connected to the right device and have the correct binary ready. Then go to **Controller → Update Firmware** and select the appropriate binary that you have received from BNC or downloaded from the BNC website. The update will take a few seconds, and after completion the device will reboot. Reconnect to the device and continue using the device.

Store and Revoke Instrument States

Ten different memory states are available to store the Frequency/Power pairs. By clicking on the **Memory Settings** button, the currently saved memory settings are displayed and can be modified as shown in Figure 5. To modify or enter a state, click on the appropriate line and enter Frequency in Hz and Power in dBm.

Memory 1 is used as default state when the 835-3 is powered up.

The 10 memory states can be accessed via the RF on/off button on the front panel. Press the RF on/off button for about three seconds until the memory setting is displayed on the screen (*). Release the button and browse through the ten memory states by pressing the RF on/off button quickly. To select the currently displayed memory state, press the RF on/off button and hold it for another three seconds. The instrument settings are updated from memory and the display now shows the CW parameters.

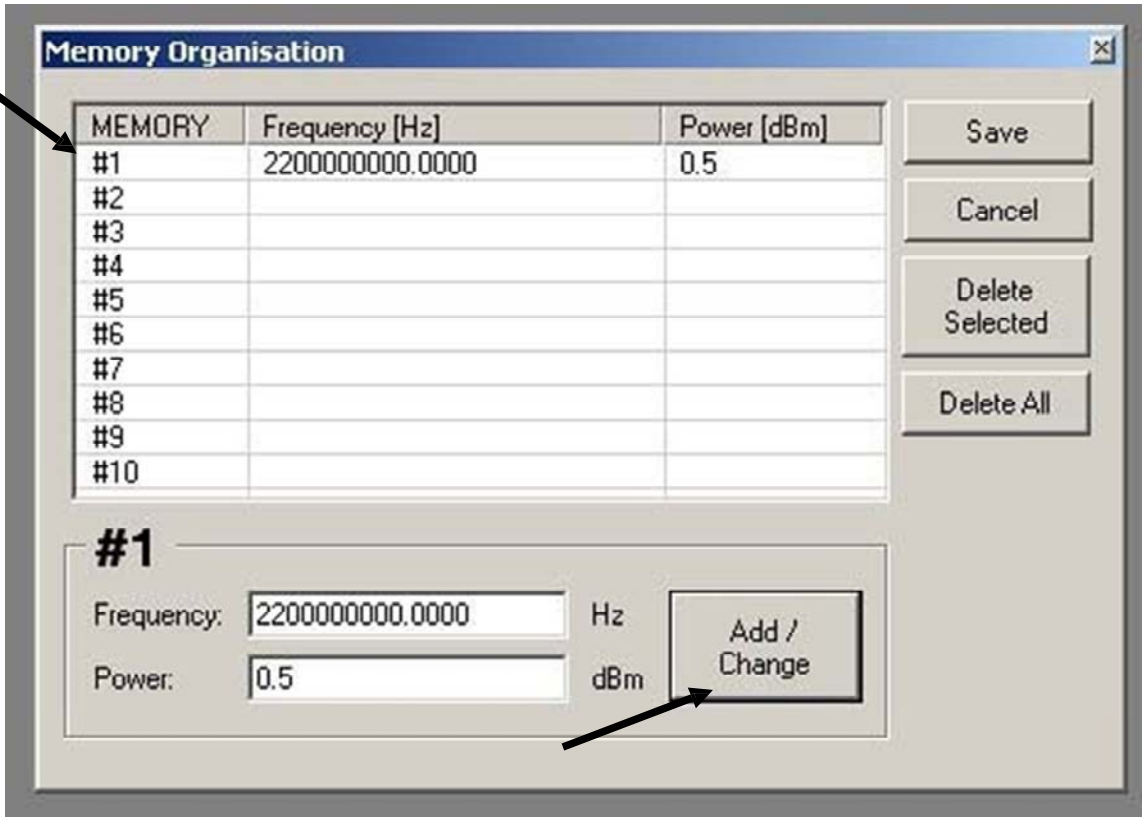


Figure 5 Memory Settings Submenu

(*) In option HC instruments all settings are individually controlled, the RF on/off button does not provide this function.

Using Toolbars

In this Software Version there are two Toolbars available.

Standard toolbar:

Close the Application

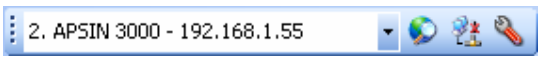
Connect / Disconnect

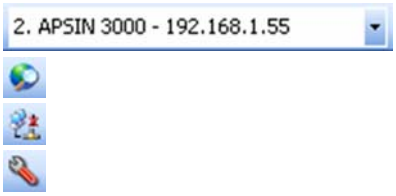
Save to Memory

Network Configuration

Reset System

Restart Controller

Network toolbar: 



Rescan devices Connect / Disconnect Network Configuration

device selection

Basic CW Operation

The 835-3 is a laboratory instrument designed to generate a synthesized CW signal with good spectral purity and variable amplitude. To set a desired frequency, relative phase and amplitude, click to the **CW tab** (Figure 6). The desired frequency, phase, and power can be set by clicking on the up and down arrows above and below each digit. The frequency is settable in steps of 0.001 Hz, the phase is settable in steps of 0.1 deg, and the power in steps of 0.1 dB.

The **RF ON / OFF button** turns the RF power on and off. The green LED in the RF ON button indicates that the RF output is enabled.

The **Save to Memory** button allows you to save the current frequency/power pair to be stored in one of the ten internal memory states.

Figure 6 CW tab

Sweeps

Besides the basic CW operation, the 835-3 supports several frequency and power sweeping modes. Sweep parameters can be set in the **SWEEP tab** (Figure 7). Select frequency, power or list sweep by clicking on the **FREQ. SWEEP**, **POWER SWEEP, or LIST SWEEP tab**, respectively.

Frequency Sweep (Figure 7)

To start a frequency sweep,

a) enter start and stop frequency in Hz unit,
b) enter the number of points (or points per decade),
c) enter the dwell time in milliseconds (min. dwell time is 50 microseconds),
d) enter the off time in microseconds,
e) select the sweep mode as linear or log; additionally click “random” if random sequence is desired.
f) select the repetition mode: enter number of repetitions or choose “infinite”

g) select the ALC mode: on, hold or off. Generally, ALC on is used. If very short dwell times (1-2 ms) are needed, the ALC can be set to “hold”. This way the ALC loop is disabled during the sweep. The ALC voltages are calibrated before the sweep to maintain high level accuracy during the sweep.
h) press the on/off button.

The time resolution is 200 ns. Note that the sum of the dwell time and the off time must be greater or equal 1.0 ms. The dwell time must be at least 50 μs, the off time can be also be 0 (no off time). When “auto” is selected, the off time is automatically adjusted such that during switching transients the output is disabled and the sum of dwell and off time are at least 1.0 ms.

Under “repetition mode” you can select how many times the sweep should be executed by entering 1 to N times, or select infinite. Selecting “Rand” will sweep the frequencies in a random manner until terminated by user. In all cases the frequency returns to the CW frequency as soon as the sweep is terminated.

Start and stop the sweep by pressing the **ON/OFF button**.

The switching transient between frequency steps depends on the step size and if internal bands of the synthesizer are crossed. Typical switching transients are <10 μs for a <100 MHz step (no band crossing) and <50 μs for arbitrary steps at output frequencies >143 MHz. Transients of 100 μs can be noticed for arbitrary steps at output frequencies <143 MHz. Transients of 400 μs occur only when switching from above 400 MHz to a frequency below 400 MHz.

Frequency Linear Sweep

Sweeps linearly from start to stop frequency in constant steps. Frequency step size is (f_stop-f_start)/number_of_points. If start<stop then negative frequency steps are performed.

Frequency Log Sweep

Sweeps logarithmically from start to stop frequency in a given number of points per decade.

Frequency Random Sweep

The output frequency is selected randomly between start and stop frequency. The number of different output frequencies is determined by the number of points selected by the user.

Power Sweep (Figure 8)

To run a power sweep, enter start and stop power in dBm unit, the number of steps, dwell and off time in milliseconds. Dwell time is at least 50 μs, the sum of the dwell and off time must be at least 400 μs. When “auto” is selected, the off time is automatically adjusted such that during switching transients the output is disabled and the sum of dwell and off time are at least 400 μs.

Select, if the sweep should be run a predefined number of times (enter desired number) or infinite times (selecting infinite). Select ALC settings. Start and stop the sweep by pressing the **ON / OFF button**.

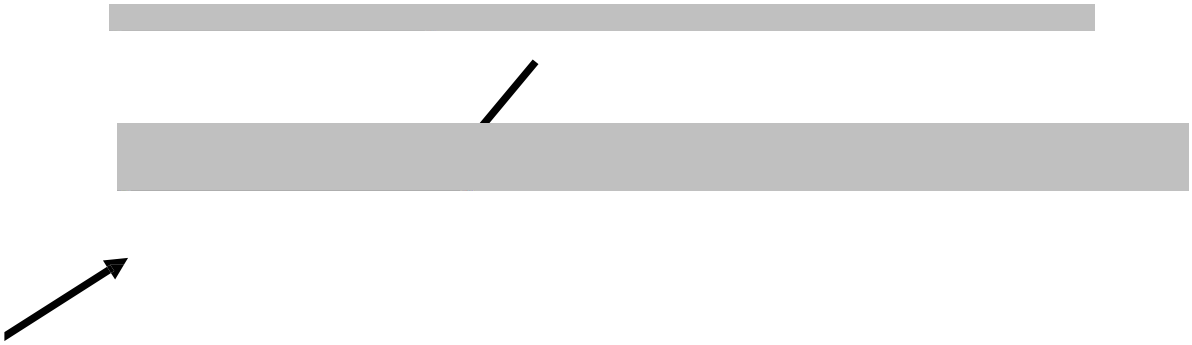


Figure 7 FREQENCY SWEEP tab

List Sweeps (Figure 9)

List sweeps allow to set frequency, output power, dwell time, and off time for each entry individually. To start a list sweep, the following steps are required:

a) select sweep parameter

b) select indexing

c) upload list file from computer (CSV-file)

d) select number of repetition

e) select the ALC mode: on, hold or off. Generally, ALC on is used. If very short dwell times (1-2 ms) are needed, the ALC can be set to “hold”. This way the ALC loop is disabled during the sweep. The ALC voltages are calibrated before the sweep to maintain high level accuracy during the sweep.

f) start sweep with on/off button

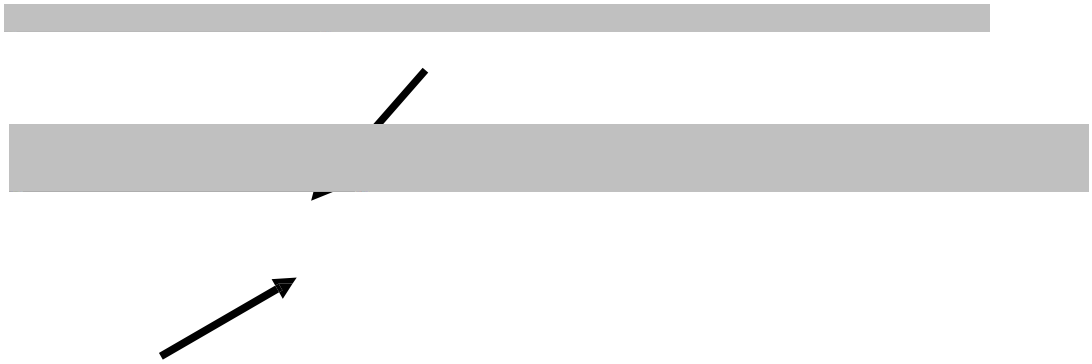


Figure 8 POWER SWEEP tab

You can select if you want frequency, output power, or both to be swept. If only one of the two parameters is selected, the second parameter is held constant during the sweep. The value is set to the value in line 1 of the CSV file.

You can choose the indexing of the list to go up, down, or be random. If you select random indexing, the index is randomly chosen for N times where N is the number of list points.

The input file must be a 4 column CSV file with the following syntax on each line:

frequency [in Hz]; power [in dBm]; dwell time [in μs]; off time [in μs]

Note the four entries in each line must be separated by a ***semicolon***.

Figure 10 shows a valid list file with four points displayed in Microsoft Excel. Each line describes one list point. The first line must contain all for entries, in any other line entries may be omitted.

Lists may contain up to **3'501 lines**.

The dwell time must be at least 50 μs. The off time may be set to zero if the output is not to be disabled during transients. **The sum of dwell time and off time must at least**

1.0 ms. Transient times depend on the frequency steps and are typically less than 10 µs for a 100 MHz step.

The number of repetitions determines how many times the lists will be executed.

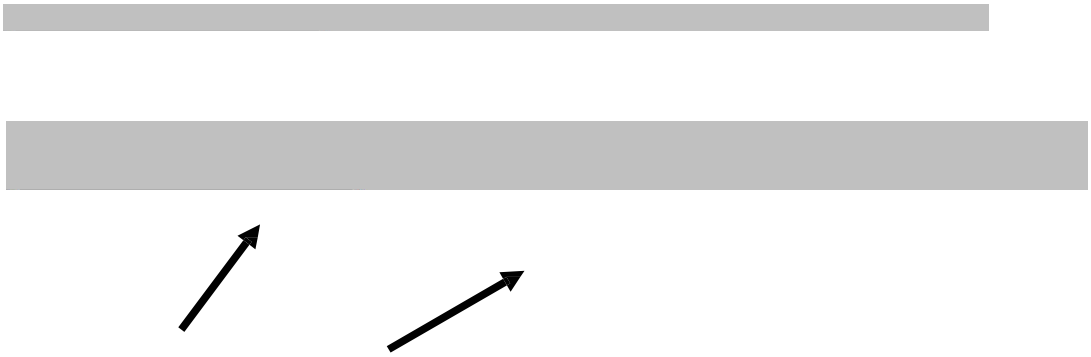


Figure 9 LIST SWEEP tab

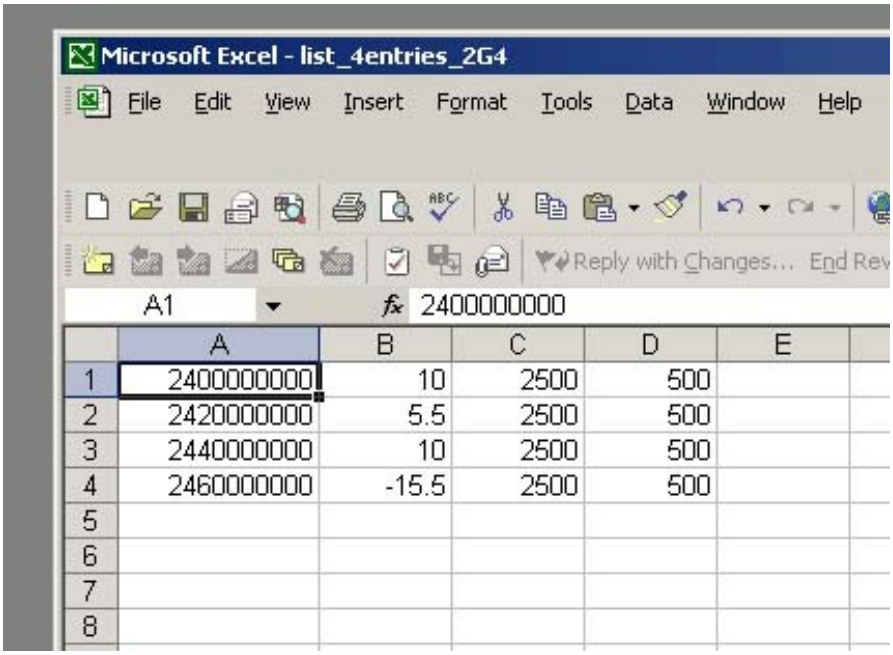


Figure 10 CSV-file with four points(1st column: frequency in Hz, 2nd: power in dBm,

3rd: dwell time in μs, 4th: off time in μs).Values must be separated by semicolon!

Modulation Control

The 835-3 provides various modulation capabilities that can be accessed by the **MODULATION tab** (Figure 11). On the left, the internal pulse modulation can be preset and started with the ON/OFF button. Enter pulse width and modulation period in milliseconds as required. Note that pulse width accuracy is approx. ±0.1 μs.
When external pulse modulation is used, the **ext. Pulse Enable** must be checked. Invert the polarity of the external video signal by checking **Inverse Polarity**.
The internal AM can be enabled by pressing the ON/OFF button in the AM portion of the submenu. Modulation depth can be selected from 1 to 99 %. AM modulation rate can be set from 1 Hz to 10 kHz.

The frequency and phase modulation settings can be accessed by selecting tab **FM/PM** (Figure 12). Enter the desired sensitivity per Volt for either frequency or phase modulation and press the **ON/OFF button.** The BNC connector **FM/PM** on the rear panel is now activated. Connecting the FM/PM input to the **FUNCT OUT** output by a 50 Ω BNC cable generates internal modulation. The internal low frequency generator is used to provide the modulation signal (see the chapter about the LF OUT control).

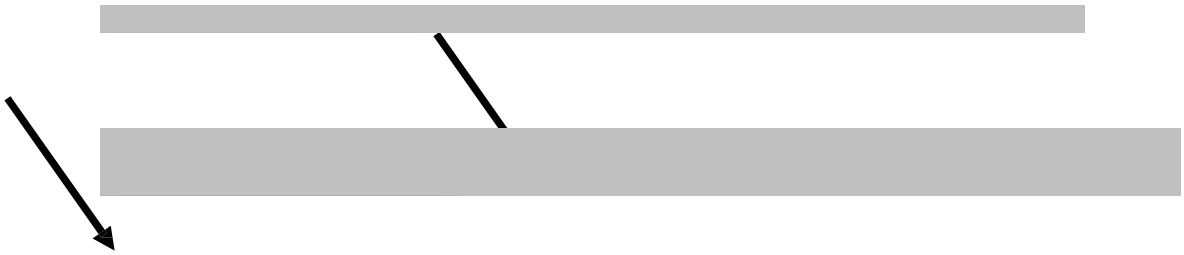


Figure 11 MODULATION tab for pulse and AM modulation

Figure 12 MODULATION tab for frequency and phase modulation

Reference

The 835-3 can be locked to an external frequency reference by connecting to the external reference input in the rear panel. To enable the external reference, go to the **REFERENCE tab** (Figure 13). Click **Use ext. reference** and enter the reference frequency. The reference frequency must be an integer multiple of 1 MHz. The maximum frequency is 100 MHz. Enter the reference frequency as appropriate. The lock status is shown as **Locked** (green color) or **Not Locked** (red color). Note that if phase lock is not achieved, the applied external reference frequency deviates by more the +/- 1.0 ppm from the entered reference frequency. Make sure that your reference has the required accuracy.

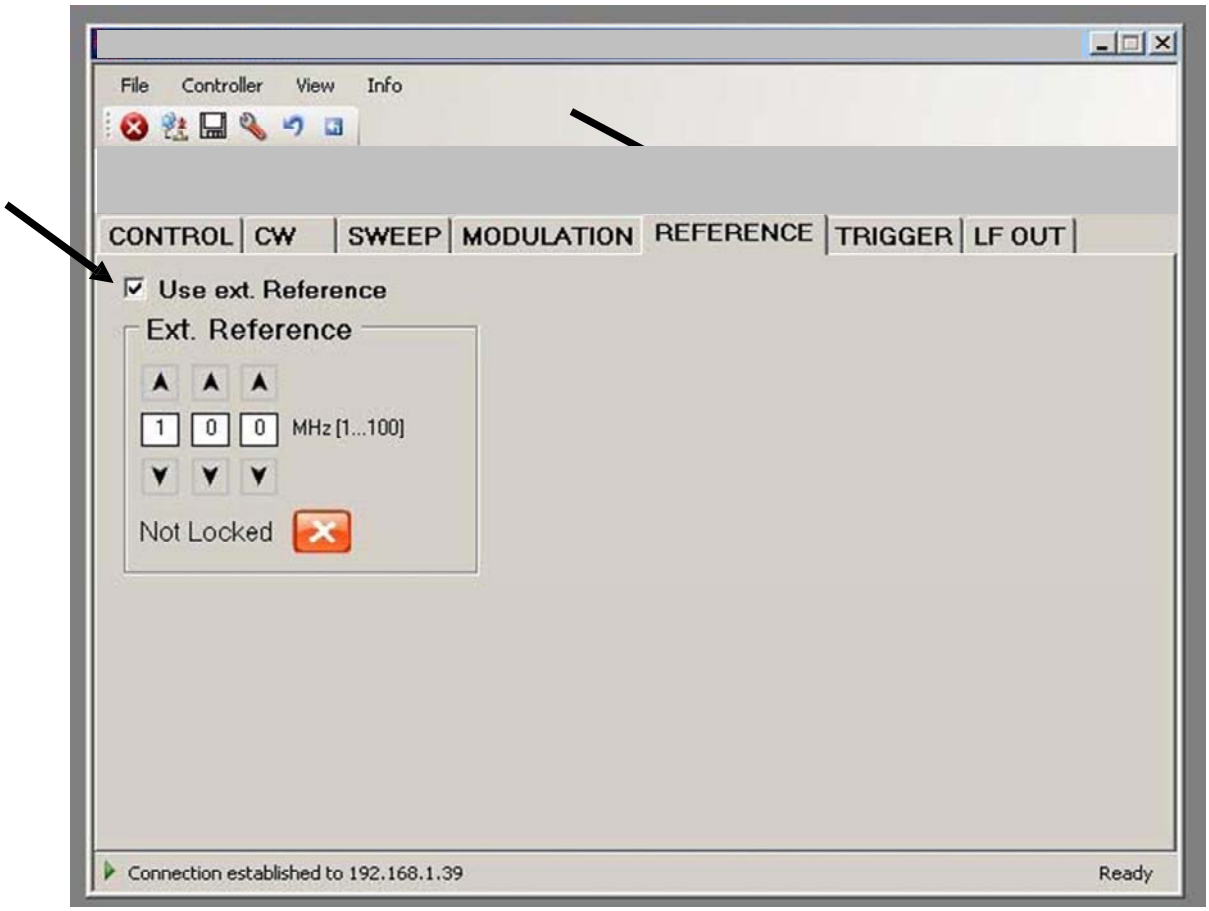


Figure 13 REFERENCE frequency setting

Using the Trigger options (Figure 14)

The 835-3 supports internal and external triggering for frequency, power, and list sweeps. To set the trigger options, go to the **TRIGGER tab** as shown in Figure 14.

Various trigger sources are available:

a) the "trigger key" which is the **RF on/off button**,

b) **LAN** (SCPI)

c) **external input** at the rear panel (currently shared with the pulse modulation input).

The **external TRIGGER** input should be a TTL logic signal.

The following trigger parameters can be defined:

a) **trigger delay**: 50 µs to 10 sec in 1 µs resolution predefined delay after trigger signal arrives. The trigger delay uncertainty is ±2 µs.

b) **trigger modulo**: N=1 to 255: defines every Nth trigger event to be used

c) **trigger active edge**: positive or negative

d) **trigger occurrence**: single event or repeated

e) **trigger type:** single point, complete sweep, or gated

Confirm settings and arm trigger by pressing the **Apply** button.

As soon as a sweep is programmed, the output is disabled while the trigger is expected. Upon arrival of the trigger the sweep is executed (after given trigger delay). Any trigger signal arriving during execution of the sweep will be ignored.

If single sweep has been selected, the sweep will be executed only once as soon as first trigger signal arrives. As soon as the sweep is completed, the frequency will return to the preset CW frequency.

If repeat sweep is selected, the sweep will be executed every time the trigger signal arrives. After the sweep is completed, the frequency the RF output is disabled until next trigger arrives.

With **trigger type**, the user can select the trigger either to execute only a single point from the sweep or the complete sweep. When **gated** is selected the sweep is only executed while the trigger signal is high.

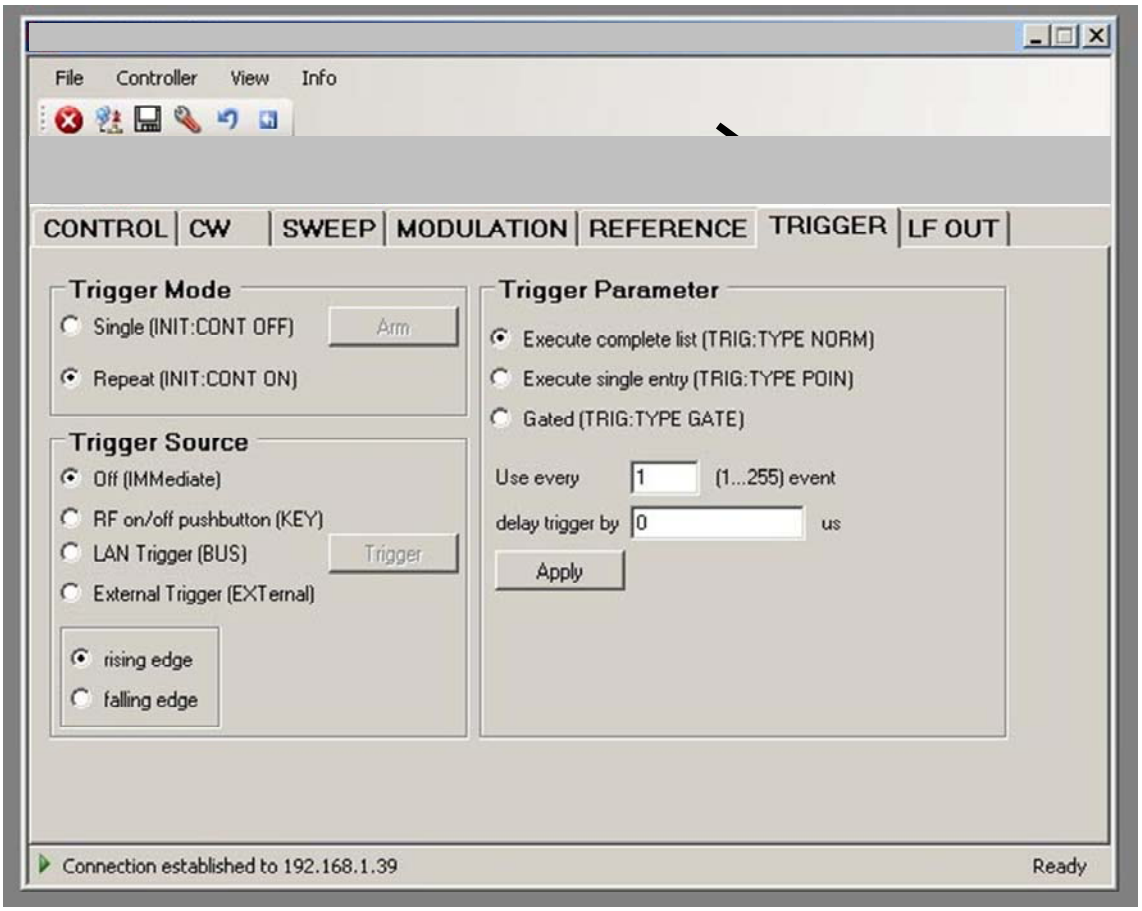


Figure 14 TRIGGER tab

LF OUT Control

The 835-3 rear panel output FUNCT OUT can be programmed using the LF OUT tab (Figure 15). The FUNCT OUT output can be used as

- Video output of the internal pulse modulation signal
- Trigger output
- Output of the low frequency generator

In the GUI, select which output to be used and enable it by pressing the ON/OFF button. The low frequency generator can output sine wave, triangle, or a square wave. The frequency can be set from 1 Hz to 5 MHz. The amplitude of the sine wave and triangle can be set for the sine wave and the triangle. If square wave ist selected, the output is not affected by the amplitude settings and gives a constant 5 Volts peak-peak amplitude.

The output impedance for sine and triangle wave output is 50 ohms, for square wave, trigger and pulse modulation video it is high impedance (CMOS and TTL logic compatible).

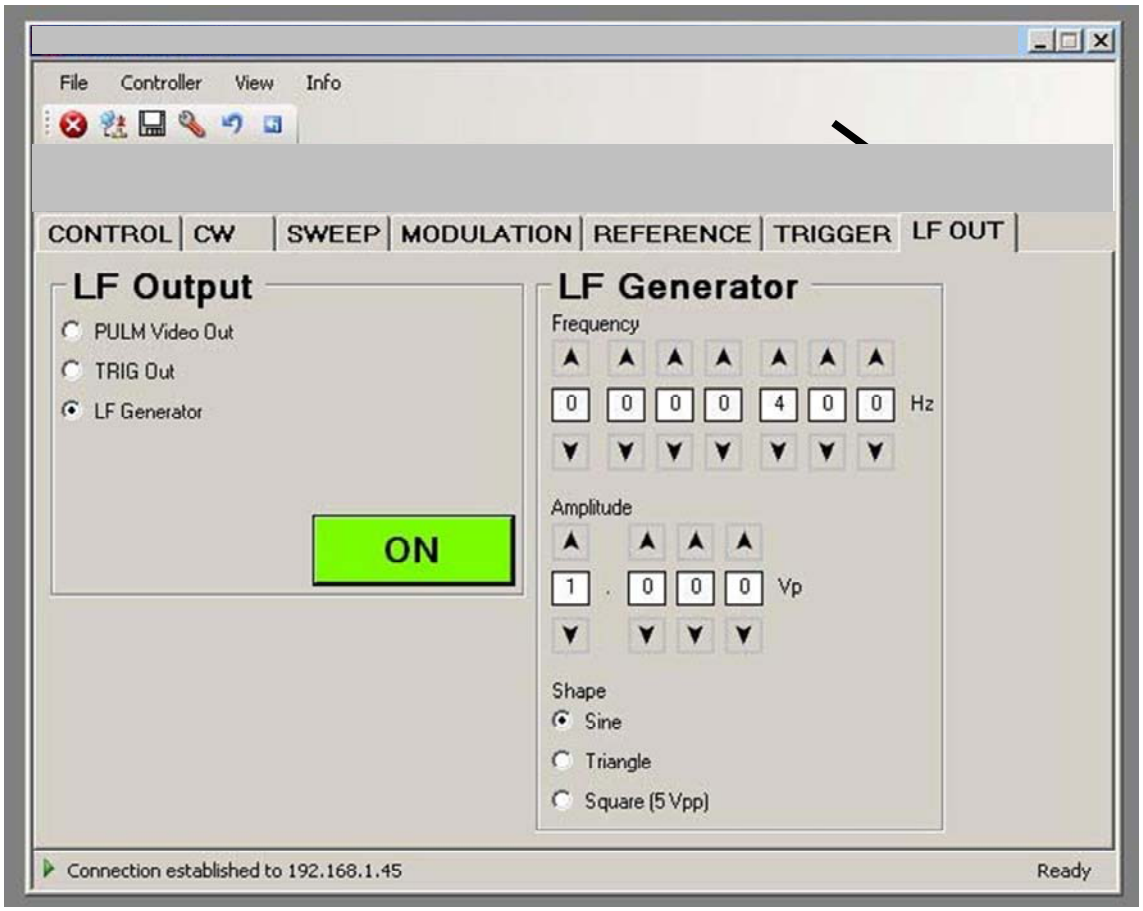


Figure 15 LF OUT tab

Combined Modulation

The table below shows what modulation types can be active simultaneously. The LF output can be used independently of all modulation types.

Table 1: Possible combinations of internal and external modulation, and the internal LF generator output.

	Ext. FM/PM	Int. AM	Int. Pulse Mod.	Ext. Puls Mod.
LF output	Yes	Yes	Yes	Yes
Ext. FM/PM		Yes	Yes	Yes
Int. AM			No	Yes(1)
Int. Pulse Mod.				No
Ext. Puls Mod.				

Notes:
(1) Always enable internal AM before the external Pulse Modulator

4. Local Operation (HC Option)

With the HC option, the instrument is controllable directly from the front panel. Moreover, simultaneous control via front panel and GUI is possible.
The HC option adds keys and a rotary knob to the front panel. Figure 16 shows the front panel view of the 835-3 with HC option.

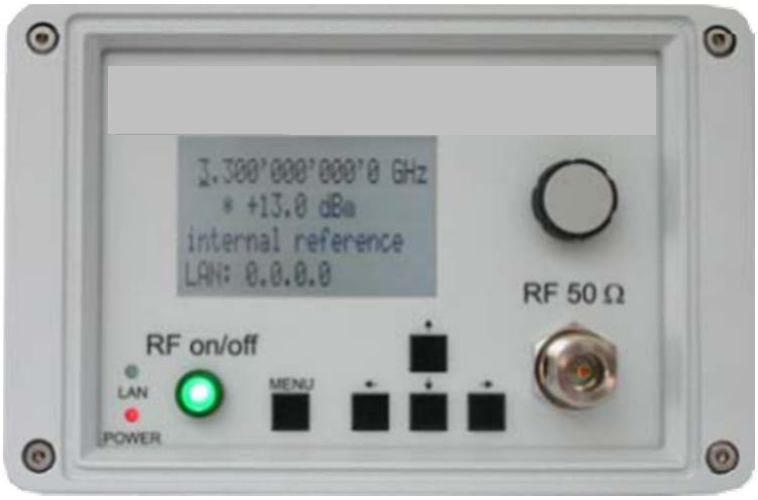


Figure 16 835-3 *Front Panel View*

RF On/Off button The **ON/OFF** key toggles between RF output on and RF output off. The green light is indicating whether the RF output is enabled (light on) or not.

RF 50Ω connector This female N- type connector provides the output for RF signals. The impedance is 50 ohm. The damage level is +30 dBm maximum. The maximum allowed DC level is +/- 10 V.

Rotary knob Varies the value at a cursor position (maked by the "_" symbol). Moves the entry cursor within the various submenus.

Menu Key This is a multifunction key. The key is used to enter and leave all the submenus displayed on the screen.

↓ ↑ → ← **Keys** These keys are used to move cursor within the screen menus.

LAN LED illuminates as soon a remote connection via LAN is active.

Power LED illuminates when system is powered up.

Displayed Parameter Formats

This section describes how to edit the frequency and amplitude and how to invoke the remaining functions of the 835-3-HC in local mode.

CW Display

The Main or CW Display is shown after the instrument has successfully booted and is ready. The four line display has the following format:

Frequency
Power

Ref. Frequency

IP Address

The currently active display position is shown by the cursor (underline symbol). The cursor does not move beyond the field of the currently selected parameter. Rotate the front panel knob to modify the value. Clockwise rotation increases the parameter and counter-clockwise rotation decreases the parameter. The parameter value will continue to increase or decrease by the amount of the selected resolution until it reaches the maximum or minimum limit of the parameter.

Use the up and down keys (↓ ↑) on the front panel to switch between frequency and power. Use the left and right arrow keys (→ ←) to select the active digit. The resolution step size is selected by positioning the cursor at the appropriate digit and then turning the front panel **rotary knob**.

Main Menu Display

The Main Menu Display is invoked my pressing the **menu key**. The main menu contains eleven submenus as shown below.

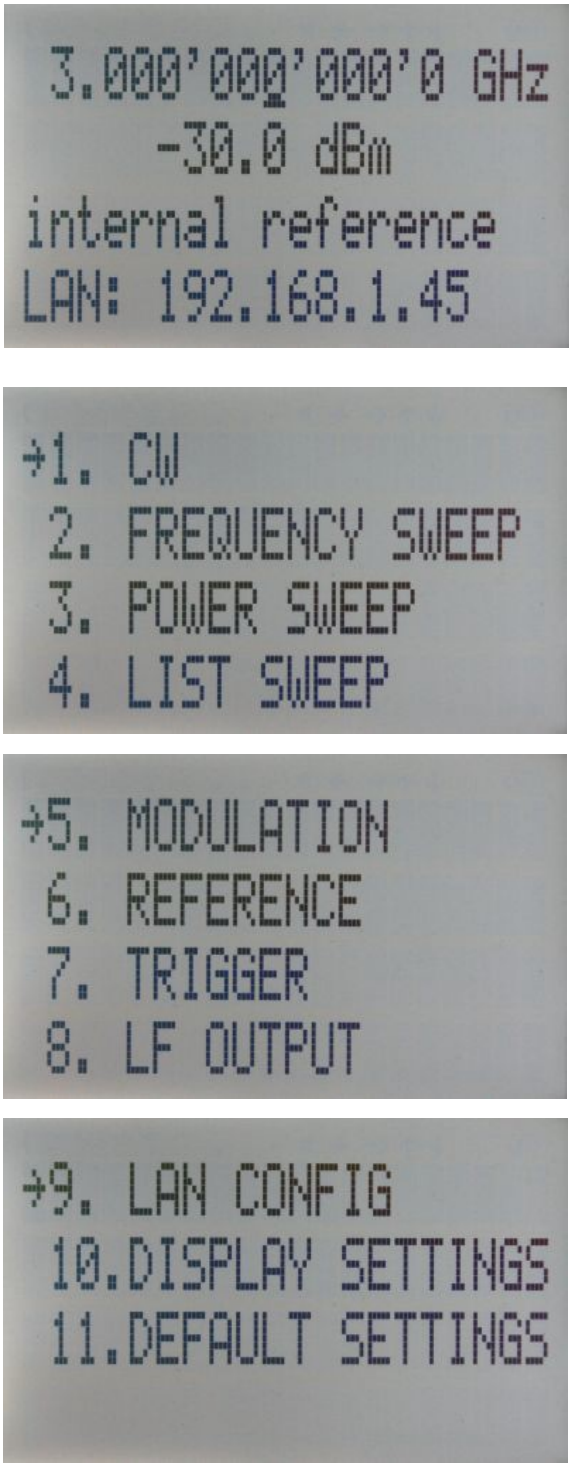


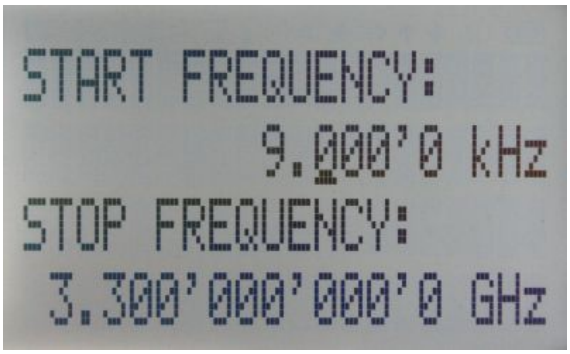
Figure 17 Overview of the submenus available on the display.

Use the up and down arrow keys (↓ ↑) or the **rotary knob** on the front panel to scroll the main menu. The arrow on the left displays the selected position. To enter a submenu, move the arrow (displayed at the left of the menu points) to the desired menu position and press the **menu key**.

Frequency Sweep Submenu

After accessing the Frequency Sweep menu, first of three displays allows to enter the start and stop frequency by using the → ← keys to select the digits and using the **rotary knob** to increase and decrease their values. Use the ↓ ↑ arrow to move between the several displays that contain settable sweep parameters. On the second display, the number of points, and the on and off time can be entered. On the third screen, select the sweep mode between LINear, LOGarithmic, and RANDom. Also select the repetition mode between INFinite, and 1 (single repetition).

Start the sweep by pressing the **RF On / Off button**. The submenus can always been exited (without starting the sweep) by pressing the **menu key**.

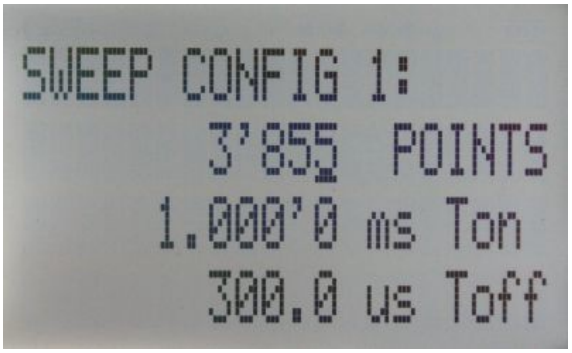


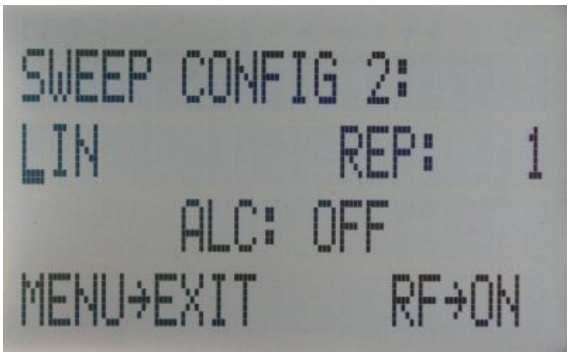
Number of Points per Sweep
On (dwell) time
Off time

Sweep Mode

Repetition
ALC on/off

Figure 18 Displays shown for the frequency sweep configuration





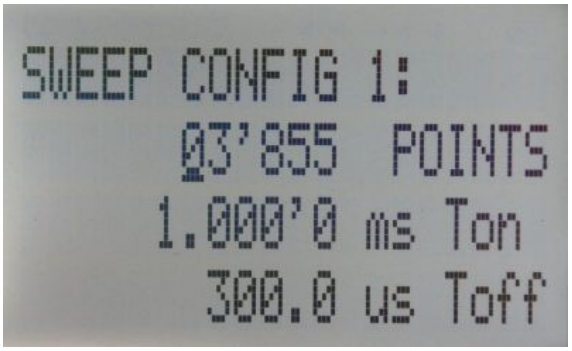
Power Sweep Submenu

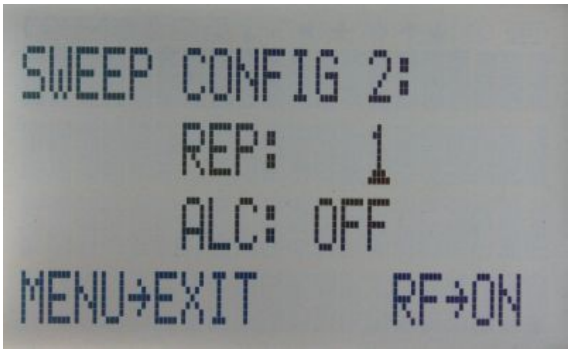
After accessing the Power Sweep menu, the first of total three displays allow to enter start and stop power by using the → ← keys to select the digits and using the **rotary knob** to increase and decrease their values. Use the ↓ ↑ arrow to move between the several displays that contain settable sweep parameters. On the second display, the number of points, and the on and off time can be entered. On the third display, select the repetition mode between INFinite, and 1 (single repetition).

Start the sweep by pressing the **RF On/Off button**. The submenu can always been exited (without starting the sweep) by pressing the **menu key**.

Number of Points per Sweep
On (dwell) time
Off time
Repetition
ALC on/off

Figure 19 Displays shown for the power sweep configuration





List Sweep Submenu

After accessing the List Sweep submenu , the first of total two displays allow to enter start and stop power by using the → ← keys to select the digits and using the rotary knob to increase and decrease their values. Use the ↓ ↑ arrow to move between the several displays that contain settable sweep parameters. On the first display the number of repetitions of the list can be entered, and the ALC can be set on or off.

On the second display, a particular list can be selected from the flash memory of the device.

Start the sweep by pressing the **RF On/Off button**. The submenu can always been exited (without starting the sweep) by pressing the menu key.

Repetition

ALC on/off

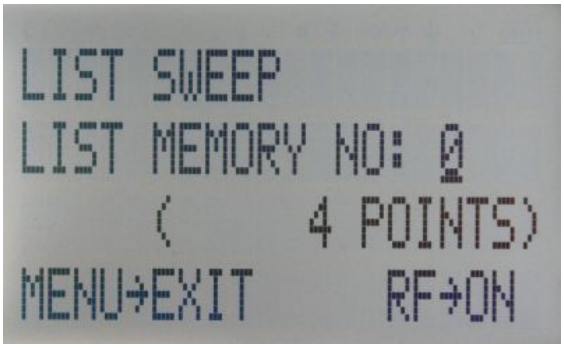
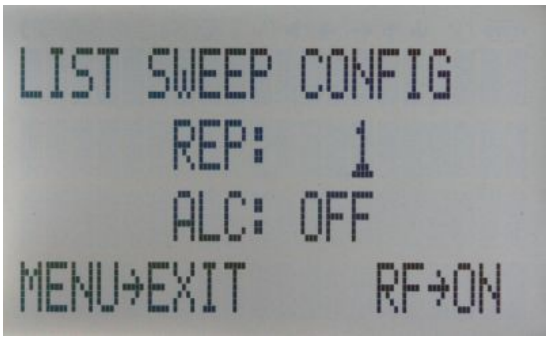


Figure 20 Displays shown for the list sweep configuration

Important note: **All sweeps must be started with the RF on/off button on (green light illuminated), otherwise no signal will be output during the sweep.**



Modulation Submenu

After accessing the Modulation menu, use the ↓↑ arrow keys to select the desired submenu entry. Press the **menu key** to enter the selected submenu. Choose EXIT to return to the main menu.

Pulse

Modulation

Amplitude

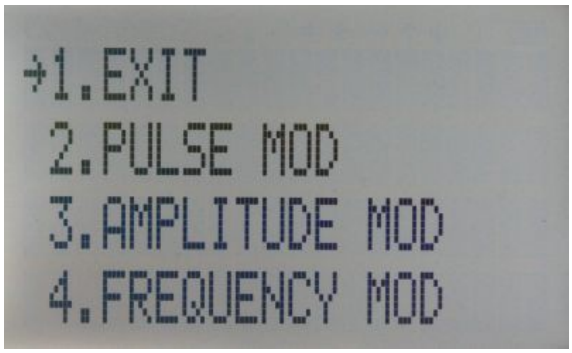
Modulation

Frequency

Modulation

Figure 21 Modulation submenu.

Pulse Mod Submenu



In the Pulse Mod submenu the pulse modulation can be accessed. Use the ↓↑ arrow keys to move the cursor to the parameter that you want to change. Use the →← and **rotary knob** to modify the parameters.

On line 1, select between INT (internal pulse generator) and EXT (external input).

If internal modulation (INT) is selected, go to line 2 to change pulse width to desired value, and go to line 3 to change pulse modulation frequency.

Enable modulation by pressing the **RF On/Off button**. Exit the submenu by pressing the **menu key**.

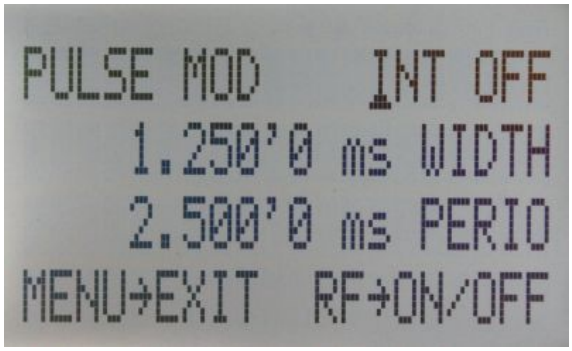


Figure 22 Pulse Modulation submenu

Amplitude Mod Submenu

In the Amplitude Mod submenu the internal amplitude modulation can be accessed. Use the **rotary knob** to set the modulation rate between 1 Hz and 10 kHz.

Enable modulation by pressing the **RF On/Off button**.

Exit the submenu by pressing the **menu key**.

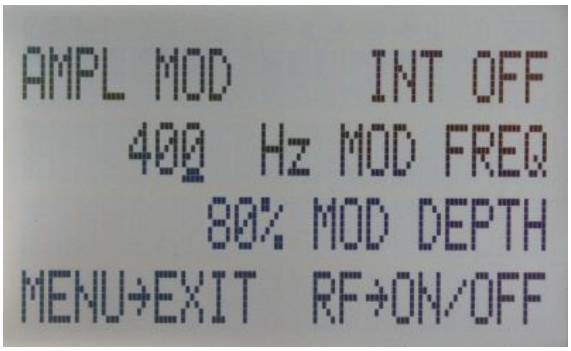


Figure 23 Amplitude Modulation submenu

Frequency Mod Submenu

In the Frequency Mod submenu the external frequency modulation can be accessed.

Enable modulation by pressing the **RF On/Off button**.

Exit the submenu by pressing the **menu key**.

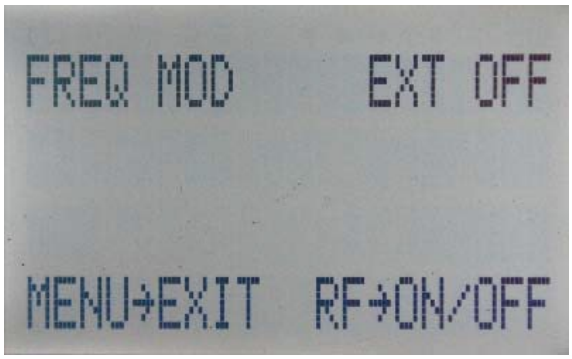


Figure 24 Frequency Modulation submenu

Reference Submenu

After accessing the Reference menu, use the ↓ ↑ arrow keys to move the cursor between the ON/OFF entry and the reference frequency entry. Use the **rotary knob** to toggle between ON and OFF, or to change reference frequency to the desired value, respectively. The display shows up as follows

Reference

ON/OFF

Ref.

Frequency

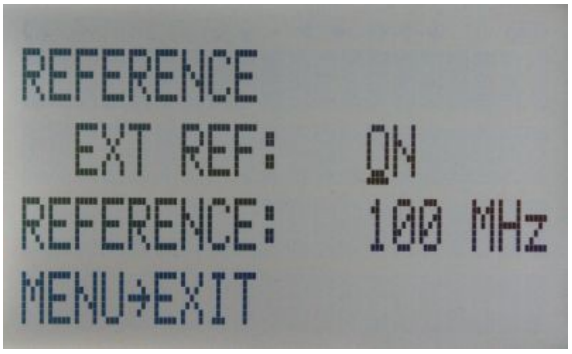


Figure 25 Reference submenu.

Confirm the setting by exiting the menu (pressing the **menu key**).

Trigger Submenu

After accessing the Trigger menu, use the ↓ ↑ → ← arrow keys to move cursor between the various menu entries. Use the **rotary knob** to toggle the selected entry value or to change selected digit. The display shows up as follows.

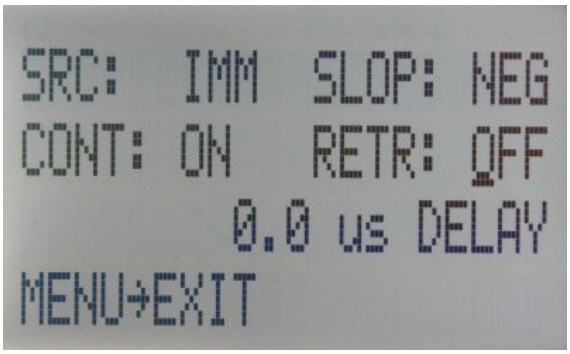
Trigger Source

Continues

Figure 26 Trigger submenu.

Trigger Slope

Retrigger (on/off/immediate) Trigger delay



Select SOURce: IMMediate, EXTernal, BUS (SCPI command), KEY (RF on/off button) Select SLOPe: POSitive, NEGative

Select CONTinuous: ON, OFF (ON means that the trigger is re-armed after each trigger occurance)

Select RETRigger: OFF, ON, IMMediate (OFF means that any trigger event during execution of list is ignored)

Enter DELAY: trigger delay in microseconds.

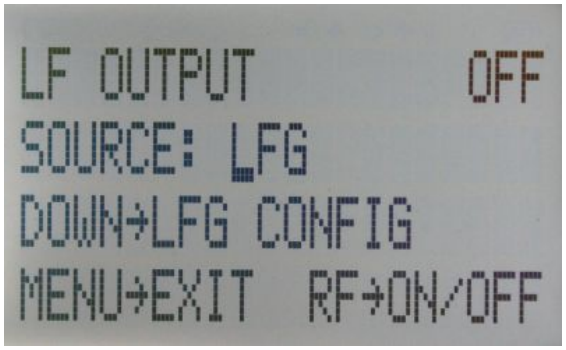
Press the **RF On/Off button** to arm the trigger. Exit the menu by pressing the **menu key**.

LF OUTPUT Submenu

In the LF OUTPUT Submenu the FUNCT OUT output at the rear panel of the instrument can be configured.

Press the **RF On/Off button** to turn the output on and off. Exit the menu by pressing the **menu key**.

On the first screen the source for the FUNCT OUT can be selected. Choose LFG for the low frequency generator, TRIG to enable the internal trigger output, and PULM to enable the pulse video output. If LFG is selected, use the ↓ arrow to proceed to the second display. Select waveform between sine, triangle, or square. Then enter the desired output frequency and voltage amplitude.



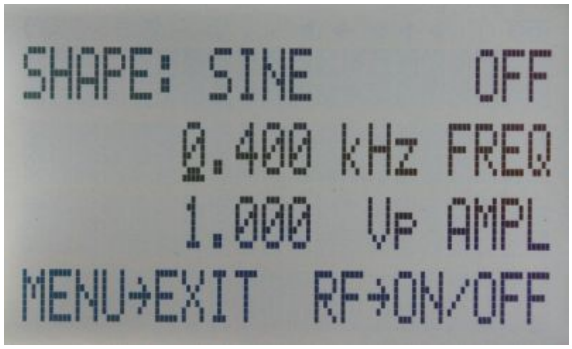


Figure 27 Displays shown in the LF OUTPUT submenu

LAN Configuration Submenu

After accessing the LAN Configuration menu, use the ↓ ↑ arrow keys to move cursor between IP address and submask address. Use the **rotary knob** to change selected digit. The display shows up as follows.

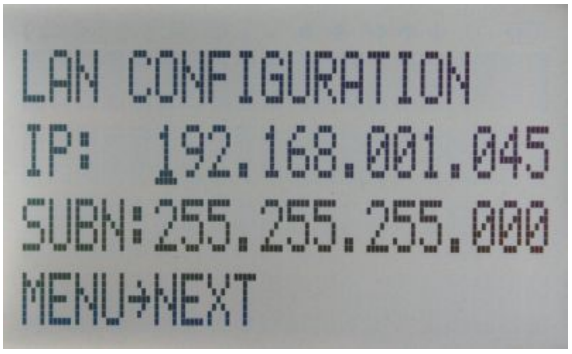


Figure 28 LAN configuration submenu (display 1).

Once you have done changes as required, press the **menu key** to continue the configuration to the second display. The display shows up as shown below:

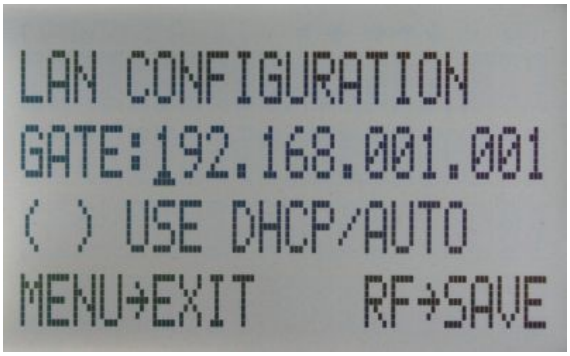


Figure 29 LAN configuration submenu (display 2).

Use the **rotary knob** either enable (x) or disable ( ) DHCP. Finally, press the **RF key** to save the configuration (don't if you want to discard your changes). Press the **menu key** to exit the LAN submenu.

Display Settings Submenu

After accessing the Display Configuration menu, use the **rotary knob** to change the display contrast as required. Press the **menu key** to save and exit the Display Settings submenu.

Figure 30 Display settings submenu.

6. Programming the 835-3

The signal generator can be remotely programmed via a 10/100/1000Base-T LAN interface and LAN-connected computer using one of several LAN interface protocols. The LAN allows instruments to be connected together and controlled by a LAN- based computer. LAN and its associated interface operations are defined in the IEEE 802.2 standard.

The 835-3 support the following LAN interface protocols:

1) **Socket based LAN:** proprietary function calls defined in the dynamic link library (DLL) provided with the instrument, used for general programming using the LAN interface under Windows operating system.
2) **VXI-11/SCPI** (version 1999) commands (firmware 2.0 upwards)

3) **Telephone Network** (TELNET): TELNET is used for interactive, one command at a time instrument control

For LAN operation, the signal generator must be connected to the LAN, and an IP address must be assigned to the signal generator either manually or by using DHCP client service. Your system administrator can tell you which method to use. (Most current LAN networks use DHCP.)

DHCP Configuration

If the DHCP server uses dynamic DNS to link the hostname with the assigned IP address, the hostname may be used in place of the IP address. Otherwise, the hostname is not usable.

Using Sockets LAN

Sockets LAN is a method used to communicate with the signal generator over the LAN interface using the Transmission Control Protocol/Internet Protocol (TCP/IP). A socket is a fundamental technology used for computer networking and allows applications to communicate using standard mechanisms built into network hardware and operating systems. The method accesses a port on the signal generator from which bidirectional communication with a network computer can be established.

Sockets LAN can be described as an internet address that combines Internet Protocol (IP) with a device port number and represents a single connection between two pieces of software. The socket can be accessed using code libraries packaged with the computer operating system. Two common versions of socket libraries are the Berkeley Sockets Library for UNIX systems and Winsock for Microsoft operating systems.

Your signal generator implements a sockets Applications Programming Interface (API) that is compatible with Berkeley socket for UNIX systems, and Winsock for Microsoft systems. The signal generator is also compatible with other standard sockets APIs. The signal generator can be controlled using predefined SCPI functions (available from firmware 2.0 upwards) use the socket connection established in your program. Socket connection is available on port **18**.

Using and Configuring VXI-11

The signal generator supports the LAN interface protocol described in the VXI- 11 standard. VXI- 11 is an instrument control protocol based on Open Network Computing/Remote Procedure Call (ONC/RPC) interfaces running over TCP/IP.

A range of standard software such as NI-VISA or Agilent IO Config is available to setup the computer/signal generator interface for the VXI- 11 protocol. Please refer to the applicable software user manual and documentation for information on running the program and configuring the VXI-11 interface. The program is used to configure the LAN

client. Once the computer is configured for a LAN client, you can use the VXI- 11 protocol and the VISA library to send SCPI commands to the signal generator over the LAN interface. Example programs are available on request.

VISA is an IO library used to develop IO applications and instrument drivers that comply with industry standards. It is recommended that the VISA library be used for programming the signal generator. The NI-VISA and Agilent VISA libraries are similar implementations of VISA and have the same commands, syntax, and functions.

Using SCPI for 835-3

The Standard Commands for Programmable Instrumentation (SCPI) provides a uniform and consistent language to control programmable test and measurement devices in instrumentation systems. The SCPI Standard is built on the foundation of IEEE-488.2, Standard Codes and Formats. It requires conformance to IEEE-488.2, but is pure software standard. SCPI syntax is ASCII text, and therefore can be attached to any computer test language, such as BASIC, C, or C++. It can also be used with Test Application Environments such as LabWindows/CVI, LabVIEW™, or Matlab®. SCPI is hardware independent. SCPI strings can be sent over any instrument interface. It works equally well over GPIB, RS-232, VXIbus or LAN networks.

Please see the 835-3 Programmer's Manual V 1.2 for detailed description of supported SCPI commands.

Using Telnet LAN

Telnet provides a means of communicating with the signal generator over the LAN. The Telnet client, run on a LAN connected computer, will create a login session on the signal generator. A connection, established between computer and signal generator, generates a user interface display screen with ">" prompts on the command line.
Using the Telnet protocol to send commands to the signal generator is similar to communicating with the signal generator over LAN. You establish a connection with the signal generator and then send or receive information using predefined commands. SCPI commands are supported from firmware version 2.0. Communication is interactive: one command at a time. The telnet service is available on **port 18**.

Please see the 835-3 Programmer's Manual for further details.

7. Battery Operation (B3 Option)

If your 835-3 is equipped with an internal rechargeable battery (B3 option) it can be operated without the external power supply. Fully charged, the battery is good for up to three hours of operation at full RF output power. The same external power adaptor (6 V @ 3 A) is used for the battery version as for the standard 835-3 for both normal operation and charging of the battery.

There are four operating modes that are also summarized in Table 2 below:

normal operation– the external power supply is connected to the 835-3 and the device is turned ON (with the power switch on the rear panel turned ON). In this mode the 835-3 can be used as if no battery was present. The internal battery is not used and will NOT be charged.

charging – the external power supply is connected to the 835-3 and the device is turned OFF (with the power switch on the rear panel turned OFF). In this mode the 835-3 is charging the internal battery. Once the battery is fully charged, the 835-3 goes into standby mode. The time required to complete charging is approx. four hours.

standby – the internal battery is fully charged and the 835-3 is turned OFF. **battery** operation – the external power supply is disconnected and the device is turned ON. The internal battery is supplying the power until it is exhausted.

Table 2: Operating modes of an 835-3 equipped with internal battery

External power adaptor / Power Switch	supplying power	disconnected
ON	Normal operation (no charging)	Battery operation - until discharged (1)
OFF	Charging – when fully charged => standby (2)	Completely powered off

Notes:

(1) The 835-3 will switch off automatically when the battery is discharged. It is recommended that the power switch be turned to the OFF position when the battery is fully discharged.

(2) Termination of charging is automatic, the unit will then enter standby mode. The power adaptor can be left connected for any length of time.

During operation, the approximate remaining battery capacity is indicated by the battery symbol visible in the upper right corner of the display.

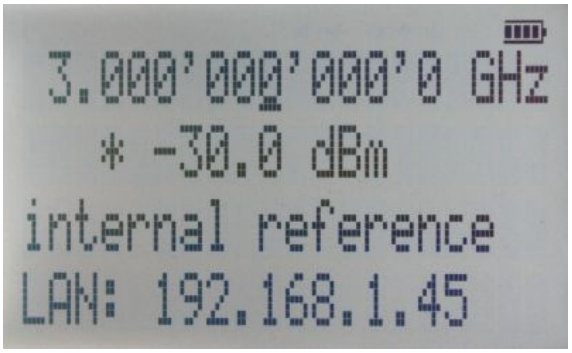


Figure 31 CW Display with Battery Symbol

Hints for maximizing the battery running time:

1. Fully charge the unit before use. For this, toggle the power switch to ON and then OFF again while the 835-3 is powered by the external power adaptor. This will initiate a new charge cycle.
2. Charging time of a completely discharged battery can be up to 6 hours. The battery will only be charged when the 835-3 power switch is in the OFF position.
3. Batteries should always be charged at room temperature. Charging the 835-3 at very low or at elevated temperatures may result in early termination of the charging process, i.e the battery is not fully charged. For safety reasons, the charging does not start when the internal temperature of the instrument is above 50 °C.
4. Check the battery indicator in the upper right corner of the display, it should indicate full charge when running on battery power after charging (4 segments).
5. Power consumption of the 835-3 is reduced when the RF power is switched off thereby increasing overall battery run time.
6. Battery run time is maximum for ambient temperature between 15 and 25 °C. Self-discharge of the battery is much faster at temperatures above 30 °C.
7. Avoid storing the 835-3 in very hot places such as behind the windshield of a car parked in the sun.

Hints for maximizing battery life expectancy:

1. The battery will reach its best performance after the first few charge-discharge cycles.
2. Always use the external power adaptor supplied with the 835-3 for normal operation and charging. This will make sure that the charging circuits work as specified.

3. Fully charge the 835-3 after running it from the battery for an extended period of time.

4. If an 835-3 with internal battery will be stored for a long period of time, fully charge it before storage, then remove the power adaptor and make sure that the power switch is in the OFF position. After storage, first charge the unit for 4-6 hours.

To replace the battery at the end of its lifetime, please contact BNC or one of its distributors.

Before using the 835-3 in battery mode for the first time, the battery must be fully charged.

Batteries must be disposed off according to the local environmental regulations.

8. Extended Power Range (PE/PE2 Options)

The 835-3 is available with options extending the power range towards lower power levels.

With these options installed, the minimum settable power level in CW operation is extended down to –150 dBm. For the guaranteed minimum power level, please consult the respective datasheet.

In **POWER SWEEP** Mode, the user shall avoid running sweeps over large power ranges (> 30 dB) for extended periods of time, as this will result in continuous switching of the mechanical attenuators and thus reduce the lifetime.

In sweeps where the mechanical attenuator is switched, the minimum dwell time increases to 20 ms.

9. Maintenance and Warranty Information

Adjustments and Calibration

To maintain optimum measurement performance, the 835-3 should be calibrated every 24 months. It is recommended that the 835-3 be returned to BNC or to an authorized calibration facility. For more information please contact our Customer Service Department at 415-453-9955 or info@berkeleynucleonics.com.

Repair

The signal generator contains no user-serviceable parts. Repair or calibration of the signal generator requires specialised test equipment and must be performed by BNC or its authorized repair specialists.

Safety

FCC notice

This equipment has been tested and found to comply with the limits for a Class A device, pursuant to **Part 15 of the FCC Rules**. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

CE notice

The 835-3 Signal Generator meets the intent of the **EMC directive 89/336/EEC** and have been designed to **EN61326 Class A Emissions and Immunity** standard.

The 835-3 also meets the intent of the **Low Voltage Directive** and have been designed to meet the **IEC 61010-1:2001** (safety requirements for electrical equipment, control, and laboratory use) standard.

Warranty Information

All BNC instruments are warranted against defects in material and workmanship for a period of **one year** from the date of shipment. BNC will, at its option, repair or replace products that prove to be defective during the warranty period, provided they are returned to BNC and provided the preventative maintenance procedures are followed. Repairs necessitated by misuse of the product are not covered by this warranty. No other warranties are expressed or implied, including but not limited to implied warranties of merchantability and fitness for a particular purpose. BNC is not liable for consequential damages.

The warranty on the internal rechargeable batteries (option B3) is one year from the date of shipment. Battery replacement is available through BNC and its distributors.

Equipment Returns

For instruments requiring service, either in or out of warranty, contact your local distributor or the BNC Customer Service Department at the address given below for pricing and instructions before returning your instrument.

When you call, be sure to have the following information available:

- Model number.
- Serial number.

- Full description of the failure condition.

Note: Model and serial number can be found on the rear of the 835-3 unit, next to the power plug.

You will get a Return Mechandise Authorization (RMA) number from BNC, please put it on the outside of the package.
Instruments that are eligible for in-warranty repair will be returned prepaid to the customer. For all other situations the customer is responsible for all shipping charges. An evaluation fee may be charged for processing units that are found to have no functional or performance defects.
For out of warranty instruments, BNC will provide an estimate for the cost of repair. Customer approval of the charges will be required before repairs can be made. For units deemed to be beyond repair, or in situations where the customer declines to authorize repair, an evaluation charge may be assessed by Berkeley Nucleonics.

Company Contact Information:

Berkeley Nucleonics Corp.
2955 Kerner Blvd.
San Rafael, CA 94901

Tel 415-453-9955
Fax 415-453-9956

info@berkeleynucleonics.com
www.berkeleynucleonics.com